January 20, 1887.

Professor STOKES, D.C.L., President, in the Chair.

The Presents received were laid on the table, and thanks ordered for them.

The Right Hon. the Lord Halsbury was admitted into the Society.

The following Papers were read:—

I. "Some Anomalies in the Winds of Northern India, and their Relation to the Distribution of Barometric Pressure." By S. A. HILL, B.Sc., Meteorological Reporter to Government, North-Western Provinces and Oudh. Communicated by H. F. BLANFORD, F.R.S., Meteorological Reporter to the Government of India. Received January 3, 1887.

(Abstract.)

In this paper the author points out that notwithstanding the great amount of light thrown upon the circulation of the atmosphere over Northern India by the accurate and intercomparable barometric and other observations made at numerous meteorological stations during the last thirteen years, there are still some unexplained anomalies connected with the wind system of that part of the world. The most important of these anomalies are the following:—

(1.) The winds of the hot season not infrequently blow against a rising barometric gradient, *i.e.*, from places where the pressure is low to others where it is higher.

(2.) The velocity of the wind has little or no relation to the distribution of pressure, but increases and diminishes with the temperature.

(3.) An unusual accumulation of snow on the North-west Himalaya during the winter and spring months causes, as Mr. H. F. Blanford has shown, unusually strong dry westerly winds over the plains during the succeeding summer; whereas the high pressure at sea-level accompanying cold over the regions to the north of India should give rise to easterly winds.

The paper is divided into three parts in which these three anomalies are discussed in order. The first part is in reality a train of inductive reasoning which leads up to the hypothesis that the cause of the

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anomalous hot winds is to be found, not in the distribution of pressure at the level of the plains, but in an interchange between the lower atmospheric strata and those at high levels, effected through the medium of convection currents set up by the diurnal heating of the earth's surface when the sun shines. This hypothesis was first put forward by Köppen to explain the diurnal inequality of wind velocity, and the author shows that in the dry season the vertical distribution of temperature in India is such that convective action capable of producing such interchange must occur.

In the second part the diurnal variation of the wind velocity is attributed to convective interchange, and it is shown that probably the annual inequality may be explained in the same way, the barometric gradients prevailing at high levels between the plains and the mountains to the north of India being subject to an annual variation dependent on the temperature. To verify the conclusions deduced from the convection hypothesis, the midday pressures at 10,000 feet above sea-level have been computed for the months of January, May, July, and October from the observations of many years at forty stations, and the resulting values have been laid down on a set of charts, another set giving the distribution of pressure at sea-level and the prevailing wind directions over India. The high level distribution of pressure, as shown on the charts, is found to be exactly such as would produce the observed anomalies in the wind direction and velocity. The charts also furnish reasons for the particular paths taken by the disturbances which bring the winter rainfall of Northern India and by the cyclonic storms originating at different seasons in the Bay of Bengal, the rule being that the storm centre follows the line of lowest pressure in a stratum of the atmosphere lying above all local obstructions such as the mountain ranges in the interior of India.

The third part of the paper is devoted to proving that in years when the summer rains fail the gradients for westerly winds at 10,000 feet over Northern India are intensified, in the first place by the unusual cold over the North-west Himalaya, due to the previous snowfall, and afterwards by the great heat of the plains, which have not been cooled by the usual precipitations in June and July. The evidence for this conclusion is not so clear as it might be; but it is shown that when the most trustworthy observations are compared the gradients for westerly winds at 10,000 feet over the Gangetic plains were very high in the remarkably dry years 1877 and 1880, whilst they were very low, that is to say, there were gradients for easterly winds over a great extent of the plain, in 1879 and 1884, which were years with excessive rain. In the moderately dry year 1883 there was a considerable gradient for westerly winds, but not nearly so great as in 1877 or 1880.

The paper is illustrated by three plates, the first giving the sea-level distribution of pressure and the wind directions all over India, the second the distribution of pressure at a height of 10,000 feet, and the third the curves of temperature decrement on ascending, both as given by observation in Glaisher's balloon ascents, and as computed on the hypothesis of adiabatic convection.

II. "Evaporation and Dissociation. Part V. A Study of the Thermal Properties of Methyl Alcohol." By WILLIAM RAMSAY, Ph.D., and SYDNEY YOUNG, D.Sc. Communicated by Professor G. G. STOKES, D.C.L., P.R.S. Received January 6, 1887.

(Abstract.)

This is a continuation of the investigation in which the authors are engaged. The measurements include the expansion of the liquid, the pressure of the vapour, and the compressibility of the substance in the gaseous state; and from these are deduced the densities of the saturated vapour and the heats of vaporisation. The total range of temperature is from $-15°$ to $+240°$; the range of pressure, from 11 mm. to 60,000 mm. The conclusions announced in their previous papers are supported by these measurements. The apparent critical temperature is 240·0°, and the critical pressure about 59,700 mm.

III. "Further Discussion of the Sun-Spot Observations made at South Kensington." By J. NORMAN LOCKYER, F.R.S. Received January 8, 1887.

In papers communicated to the Royal Society, and printed in the 'Proceedings' (vol. 31, pp. 72 and 348; vol. 32, p. 203; and vol. 33, p. 154) the sun-spot observations made at South Kensington since 1879 have been to some extent discussed.

In the last paper communicated to the Society, in May, 1886, I discussed the results obtained by the reduction of the observations of the most widened lines in the region F to *b* for the whole number of observations (700) made from November, 1879, to August, 1885.

In the latter paper it was shown that as we pass from the minimum to the maximum period included in the years named, the lines of known terrestrial elements disappear, their places being taken by lines which do not appear in any maps or tables of spectral lines. It was pointed out that such a result might be explained on the supposition that since the solar atmosphere is quietest and coolest at the